

ULTRA-THIN SILICIDATION-STOP EXTENSIONS IN MOSFET DEVICES

Abstract

Very low resistance, scaled in MOSFET devices are formed by employing thin silicidation-stop extension that act both as a silicidation "stop" barriers and as thin interface layers between source/drain silicide regions and channel region of the MOSFET. By acting as silicidation stops, the silicidation-stop extensions confine silicidation, and are not breached by source/drain silicide. This permits extremely thin, highly-doped silicidation-stop extensions to be formed between the silicide and the channel, providing an essentially ideal, low series resistance interface between the silicide and the channel. On an appropriately prepared substrate, a selective etching process is performed to expose the sides of the channel region (transistor body). A very thin layer of a silicidation-stop material, e.g., SiGe, is disposed in the etched away area, coating the exposed sides of the channel region. The silicidation-stop material is doped (highly) appropriately for the type of MOSFET being formed (n-channel or p-channel). The etched away areas are then filled with silicon, e.g., by an Si epi process. Silicidation is

then performed (to form, e.g., CoSi_2) on the newly filled areas. The silicidation stop material constrains silicidation to the silicon fill material, but prevents silicide expansion past the silicidation stop material. Because the germanium (Ge) in SiGe is insoluble in CoSi_2 , the SiGe acts as a barrier to silicidation, permitting silicidation to go to completion in the Si fill but stopping silicidation at the SiGe boundary when silicidation is performed at a temperature above a silicidation threshold temperature for Si, but below a silicidation threshold temperature for SiGe. This results in a very compact, well-defined lateral junction characterized by a thin layer of SiGe disposed between silicide lateral extensions and the sides of the channel region. Because of the thin, highly-doped SiGe layer between the channel and the silicide lateral extensions, the extension resistance is very low.